

Association for Machines and Mechanisms News Bulletin

Volume 11, No. 3

July 2019



Objectives and Activities

The main objective of AMM is to contribute to mechanical design at all levels starting from academic research to industrial initiatives, thereby enhancing the quality and reliability of indigenous machines. With this in view, AMM organises the International & National Conference on Machines and Mechanisms, iNaCoMM, and the workshops on Industrial Problems on Machines and Mechanisms, IPRoMM regularly.

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Message from the Editor-in-Chief

After celebrating the Independence Day, publication of Volume 11 No. 3 July 2019 issue of the Bulletin of the Association for Machines and Mechanisms is finalized. Previous to this issue, a combined January and April (1 & 2) issue, 2019 of Volume 11 of the Bulletin of the AMM was brought out. As intimated by Prof. Pushparaj Mani Pathak, the Secretary of the AMM, this issue is the last issue being edited by the existing Editorial team, and I was requested to edit the same. A new editorial team headed by Prof. S. Sanyal, Professor Mechanical Engineering, NIT, Raipur will take over the responsibility for publishing the Bulletin of the Association for Machines and Mechanisms from the next issue.

The present Office Bearers are heartily thanked for their active support to bring out this issue of the Bulletin of the AMM.

Bulletin of the AMM **Volume 11, No. 3, July 2019** issue is being published with the sole responsibility bestowed on Prof. Santanu Das, the Editor-in-Chief. And he is fully responsible for the delay in publishing this issue.

The Proceedings of the 5th MMS Conference 2018 is included in this issue. Prof. G. K. Ananthasuresh, Vice President of the AMM, is acknowledged for contributing the same. A number of Brochures of forthcoming events is included in this issue as usual.

AMM members and others are requested to contribute articles and technical briefs to the new editorial team for the next October 2019 issue.

On behalf of the entire Editorial Team of the Bulletin of AMM who was responsible for bringing out the Bulletin issues for over last 5 years, I thank all concerned for their active support, good wishes and suggestions for bringing out of this Bulletin regularly.

Hope similar support will also be provided by all to the New Editorial Team. CONGRATULATIONS to the New Team Headed by Prof. S. Sanyal for assuming the new position!

Prof. Santanu Das
Editor-in-Chief

August 24 2019

About the Association of Machines and Mechanisms (AMM)

The AMM headquarter is currently located at the Department of Engineering Design, IIT Madras. A new set of office bearers have taken charge of the affairs of AMM. AMM invites both individual and corporate membership from Indian academia, research organizations and industry. Membership benefits and other information about AMM are available at www.ammindia.org. The body of Zonal Vice Presidents (ZVPs) is active over the past several years with representations from the four corners of the country. They are playing the role of nodal agencies so as to decentralise the AMM official activities and to organise workshops under the aegis of AMM to popularise the mechanism science in their respective regions. They also form the editorial team of this news bulletin. AMM invites contributory articles from its members and others working in the various fields of mechanisms science for this quarterly news bulletin. Interested people can contact the editorial team.

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**We are made wise not by the recollection of
our past, but by the responsibility for our
future.**

--- George Bernard Shaw

Proceedings of the 5th Asian MMS Conference Held in IISc, Bangalore during December 17-19, 2018

G. K. Ananthasuresh¹, Dibakar Sen², Santhakumar Mohan², G. R. Jayanth³ and Rajeevlochana Chittawadigi⁴

¹General Chair, ²Chairs of the Technical Committee, ³Chair of the Organising Committee,

⁴Coordinator of the Pre-conference Symposium

5th Asian Mechanism and Machine Science (Asian MMS) Conference

International Federation for the Promotion of Mechanism and Machine Science (IFTToMM) is a global organization that has been striving for half a decade, as its name suggests, to promote the field of kinematics, mechanisms, and machines. One of IFTToMM-affiliated journals, *Mechanism and Machine Theory*, is a flagship journal of the field. IFTToMM's World Congress, the biggest global gathering of the researchers in this field is held every four years. Thus, it made sense to have a regional conference at the continent level every other year. Asian Mechanism and Machine Science (Asian MMS) grew out of that desire and began in Taipei in 2010 and subsequently held in Tokyo (2012), Tianjin (2014), Guangzhou (2016), and Bengaluru (2018). The IFTToMM member organization in India, Association of Mechanisms and Machines (AMM), holds its own conference in odd years with the name National Conference on Mechanisms and Machines Conference (iNaCoMM) (the prefix "i" added in its abbreviation as this conference attracts a few international researchers). India has a longstanding tradition in mechanisms with excellent research done in many parts of the country. Prof. J. S. Rao is a founding member of IFTToMM. He had chaired IFTToMM World Congress held in 1983 in New Delhi. Many Indian researchers have participated in IFTToMM conferences for a long time. It is thus fitting that the 5th Asian MMS 2018 was held in Bengaluru, India, during December 17-19, 2019. It was held in the J. N. Tata Science Seminar Complex in the Indian Institute of Science (IISc) campus.

The Asian MMS conference, although primarily intended for Asian countries, serves as a global platform for the participants to exchange ideas and present their research in the fields of mechanisms and transmissions with special emphasis on industrial applications in order to stimulate the exchange of new and innovative ideas. This conference is an opportunity to present and share one's research results with interested professionals and researchers who are at the front line of mechanism and machine theory. The papers presented in this conference were divided into different sessions that cover many topics: Mechanism and Machine Design, Gearing and Transmissions, Actuators and Sensors, Assistive Devices, Robotics, Walking Robots, Modeling and Simulation, Dynamics, and Compliant Mechanisms.

We had received 132 abstract submissions in which, after a first stage of the review process, 85 were submitted as full papers, which were then carefully reviewed by three reviewers per paper in a single blind-review process. There were 82 papers accepted for presentations during the conference. Finally, 76 papers were registered for the conference; in this list, there were 68 oral presentations and eight interactive presentations. Furthermore, country wise distribution of these papers was as follows: four papers from China, three from Indonesia, two papers each from Poland, Turkey, and USA, one each from Germany, Italy, Japan, Russia, and Spain. The major portion of papers was from India: 58 from various regions of India. We want to express our thanks to the reviewers who contributed to the review process with their experience and expertise. Only through their effort was it possible to organize a thorough yet speedy review. The

papers revised after the conference based on the feedback received during the conference and the extended abstracts of four plenary talks are part of a Springer book, which is in the press.



[Left: Nitin Gupta from Sickle Innovations, Right: The IFTToMM Executive Council at Asian MMS 2018]

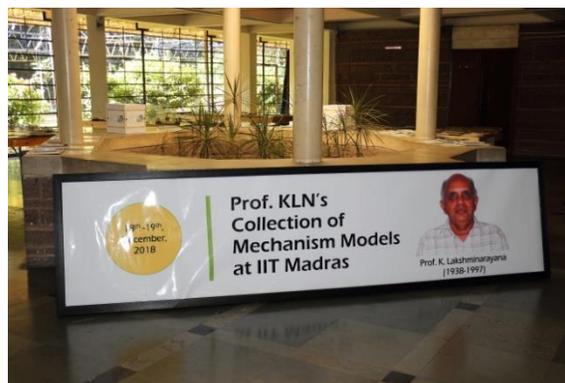
The field of kinematics, mechanisms, and machines is considered an old hat by some. It is far from true. The field is changing with times and so are the researchers in the field. Most researchers familiar to us in this field have gradually and deftly diversified into other areas while retaining their love for geometry, kinematics, and computational methods. Design, manufacturing, controls, automation, robotics, sensors, actuators, micro and nano systems, bioX, etc., are all the allied fields that have been influencing the IFTToMM community and are equally being influenced by the same community. It is thus an inclusive field and carries with it the charm of contributing its share in transforming the world since the first industrial revolution and continuing to do so in the fourth. We celebrated that spirit in Asian MMS 2018 too.

On December 17 2018, the day before the two-day conference, there was a symposium on Machines and Mechanisms for Agricultural and Rural Applications. It was held in lieu of the symposium on Industrial Problems in Machines and Mechanisms (IProMM). The symposium included talks by Prof. Jaywant Arakeri, Prof. Manjeet Singh, Prof. Sandipan Bandyopadhyay, and Prof. Balakrishnan Shankar from academia; Mr. Nitin Gupta, Mr. Manohar Sambandam, and Mr. K. Rajeshwar from the industry. The day ended with launching of a new journal of Springer, *Journal of Vibration Engineering and Technologies*. The editor-in-chief, Prof. J. S. Rao, and Ms. Swati Meherishi coordinated this event. The IFTToMM Executive Council chaired by Prof. Marco Ceccarelli had its meeting through the first day with eight members who came from different parts of the world.

The conference began on December 18th with a brief inaugural session attended by Prof. Anurag Kumar, Director of IISc, who addressed the gathering and recalled the kinematics and mechanisms tradition in IISc that started with Prof. T. S. Mruthyunjaya and continuing today. The first two plenary talks were given by Dr. M. Annadurai of Indian Space Research Organization and Prof. Shin-ichiro M. Nomura of Tohoku University in Japan. An exhibition of Late Prof. K. Lakshminarayana's (Prof. KLN as he was known) collection of mechanism models (loaned from IIT-Madras) and compliant mechanisms of Multidisciplinary and Multiscale (M2D2) Laboratory of IISc, was inaugurated by Prof. Amitabha Ghosh. Nearly 150 mechanism models were on display on both days of the conference in *please-touch* mode.

There were three parallel sessions for contributed papers, one flash-talks session for presenting interactive poster papers, one poster session on December 18th and 19th. The first two sessions on both days commenced with invited talks by eminent researchers: Prof. A. P. Sudheer, Prof.

Sujatha Srinivasan, Prof. Sunil Agrawal, Prof. M. I. Can Dede, Prof. Lateefah Nuhrami, and Prof. Shital Chiddarwar.



[Left: Inaugural session of Asian MMS 2018, Right: Exhibition of mechanism models of Prof. K. Lakshminarayana (KLN)]



[Left: Professors admiring German mechanism models, Right: Compliant mechanism models of M2D2@IISc]



[Left: Prof. Ashok Midha during his plenary lecture, Right: Safvan Palathingal receiving the best-paper award from Prof. Ghosal]

Springer sponsored three best awards, two for oral papers and one for interactive poster paper: (i) “Forward Dynamics of the Double-wishbone Suspension Mechanism using the Embedded Lagrangian Formulation” by V. Ashtekar and S. Bandyopadhyay; (ii) “A Passive Universal Grasping Mechanism based on an Everting Shell” by M. V. S. Balakunatala, S. Palathingal and G. K. Ananthasuresh, and (iii) “Cable-driven Paralle Robot with Big Interference-free Workspace” by V. A. Handojo, A. T. Syamlan, L. Nuhrami, B. Pramujati, M. N. Tamara and U. Wasiwitono. These were given in the valedictory session of the conference. The sad demise of an

author of a paper in the conference, Prof. Annem Narayana Reddy of IIT, Guwahati, who passed away a few months before the conference was noted with regrets. A minute of silence was observed by all at the beginning of the valedictory session.

On December 20 2018, a bus-load of conference delegates embarked on a day-trip to visit historic monuments in Beluru and Halebeedu and also trekked the hill on top of which the giant statue of Bahubali, Mahavir Jain, is located. Dr. Shanthanu Chakravarty had carefully planned the trip.



[**Left:** Prof. Amitabha Ghosh released a mathematics puzzles book of Prof. Asok Mallik, **Right:** Audience in the dome-auditorium of the Jawaharlal Nehru Planetarium, Bengaluru, where the conference banquet was held.]

Although organizing a conference is an arduous task, our team relished every bit of it and made it an enjoyable experience for all. The conference delegates appreciated a few offbeat experiments from the crafty name-tags (thanks to Ms. Bharathi Gondi of Cellulose Jewellery) to an exhibition of Indian mechanism models (a collection of an eminent kinematician Prof. K. Lakshminarayana of IIT, Madras, generously loaned by IIT, Madras for this occasion; warmly inaugurated by an equally eminent Prof. Amitabha Ghosh, former professor of IIT, Kanpur), bicycle tours for early risers to roam around the verdant campus of IISc, an astronomy show and an exciting talk by Prof. Asok Mallik (retired professor from IIT, Kanpur) in the dome-auditorium of city's planetarium (thanks to Planetarium's Director, Dr. Madhusudan and staff), a compliant box in lieu of yet another conference bag, a calendar of 2019 with great kinematicians (thanks to Prof. Marco Ceccarelli, current President of IFToMM), and finally, a novel networking opportunity with compliant mechanisms that are animated with an optical grating (one needed to trade their extra copies with 24 others who have different mechanisms and make your own unique set of 25 to win a prize; thanks to Dr. Sreenath Balakrishnan who made this possible). We hope the attendees of the conference enjoyed the conference as much as we did while preparing for it.

Comprehensive information about the conference can be found out at the website: <https://www.iisc.ac.in/conf/AsianMMS2018/>. The photo gallery posted after the conference has beautiful moments for all to cherish.

We thank Prof. C. Amarnath (President of AMM) and Prof. Ashitava Ghosal (a member of the Executive Council of IFToMM) who provided prescient advice throughout the preparation for the conference. A team of students and post-docs worked relentlessly for weeks to ensure that all was in order for the conference. We whole heartedly thank each and every one of them for their labor of love for the conference. In particular, we want to thank Mr. Safvan Palathingal, a PhD student in IISc, who helped immeasurably in all aspects of the conference from the first call for

papers to the Springer book. Ms. Chaitra Rajeevalochana and Ms. Deepika Subramani deftly handled all administrative matters and logistics.



[**Left:** A tensegrity arch designed installed at the Planetarium by Siddesh Shenoy (extreme left) of M2d2@IISc, **Right:** The organizing team of Asian MMS 2018 who worked tirelessly (those not seen here were working even harder)]



[The group photo of the conference attendees on December 18, 2018]

Finally, this conference would not have been possible without the enthusiastic participation of the authors and delegates; and gracious monetary support of the sponsors. We sincerely thank all the delegates who made our efforts worthwhile. Our sponsors included Science and Engineering Research Board (SERB) of Govt. of India, Central Manufacturing Technology Institute (CMTI), General Electric, COMSOL Multiphysics, Autodesk, Springer, MAKIT-Turning Point, and Nugenix. The seed funding and money to support five national Young Delegate scholarships were provided by AMM and two international scholarships by IFToMM. We are grateful to both organizations. A note on the finances of this conference is appropriate to end this report. The sponsorship money and registration fees came to a total of about INR 14 lakh. The expenses came to slightly less than the income so that we could return the complete seed money to AMM and IFToMM.

August 12, 2019

Forthcoming Events



2020 USCToMM MSR 1st Symposium on Mechanical Systems & Robotics May 14-16, 2020 Rapid City, South Dakota, USA <https://sites.google.com/view/usctomm/symposia>

Call for Papers

The 2020 USCToMM Symposium on Mechanical Systems and Robotics (2020 USCToMM MSR Symposium) will be held Thursday through Saturday, May 14-16, 2020, at the South Dakota School of Mines & Technology. The 2020 USCToMM Annual General Meeting will be held during the Symposium. Financial support is available through the USCToMM Student Delegates Awards to assist students wishing to present their work at the symposium (for more information, see the symposium's website).

The symposium is designed to foster meaningful interactions and collaborations: single track, peer-reviewed papers, 20-minute presentations plus 10 minutes for Q & A allowing for substantial discussions, and a social program that fosters networking and collaborations among attendees including a Friday evening conference dinner at Mount Rushmore National Memorial in the beautiful Black Hills of South Dakota.



Paper Topics

The USCToMM MSR Symposium welcomes submissions that address: Specialized Robotic Systems; Soft, Wearable & Origami Robotic Systems; Applications to Walking, Flying, Climbing, Ground, Underground, Swimming, & Space Systems; Human Rehabilitation & Performance Augmentation; Design and Analysis of Mechanisms & Machines; Human-Robot Collaborative Systems; Service Robotics; Mechanical Systems & Robotics Education; Commercialization of Mechanical Systems & Robotics; and related topics. Accepted papers will be indexed in Scopus, Ei Compendex and Web of Science.

Author Guidelines

Full papers should be submitted as an unsecured PDF file formatted according to the USCToMM LaTeX class or MS Word template (available at <https://sites.google.com/view/usctomm/symposia>). Full papers should not exceed 10 pages. All communications with the corresponding authors of each paper will be conducted by email or through the online submission system. Each corresponding author submitting a full paper will be requested to produce at least two reviews per paper submitted and at least one author is expected to register and present the paper at the symposium.

Host Organizations

- South Dakota School of Mines & Technology
- USCToMM: U.S. Committee for the Theory of Machines and Mechanisms
- IFToMM: International Federation for the Promotion of Mechanism and Machine Science

Symposium Co-Chairs

- J. Michael McCarthy, University of California, Irvine
- Pierre Larochelle, South Dakota School of Mines & Technology

Important Dates

January 15, 2020	Submission of full papers
February 12, 2020	Submission of reviews
February 19, 2020	Notice of decision
March 1, 2020	Submission of final papers
April 15, 2020	Early registration deadline

Scientific Committee

- Sunil Agrawal, Columbia University
- David Cappelleri, Purdue University
- Mary Frecker, Penn State University
- Bill Goodwine, Notre Dame University
- Larry Howell, Brigham Young University
- Andrew Murray, University of Dayton
- Carl Nelson, University of Nebraska, Lincoln
- Alba Pérez Gracia, Idaho State University
- Madhu Raghavan, General Motors
- Bahram Ravani, University of California, Davis
- Nina Robson, California State University Fullerton
- Bernie Roth, Stanford University
- Vladimir Vantsevich, University of Alabama at Birmingham

Venue

The symposium will be held in the Larry & Linda Pearson Alumni and Conference Center on the campus of the South Dakota School of Mines & Technology in Rapid City, South Dakota. 501 East St. Joseph Street, Rapid City, SD 57701, USA.



MSR 2020 is cosponsored by the Canadian Committee for the Theory of Machines and Mechanisms (CCToMM).

Forthcoming Events

The 6th Joint International Conference on IMSD The 10th ACMD 2020 The 10th Multibody System Dynamics Asian Conference on Multibody Dynamics



First Call for Papers

The Sixth Joint International Conference on Multibody System Dynamics (IMSD 2020) and the 10th Asian Conference on Multibody Dynamics (ACMD 2020) will be held during November 1-5 2020 at the Indian Institute of Technology (IIT) Delhi, New Delhi, India.

IIT Delhi is one of the 23 IITs in India which was established in 1961. It is one of the best technical institutes in India and ranked highly worldwide. The Department of Mechanical Engineering in the institute will be hosting the two conferences jointly. The Department has more than 40 faculty working in different areas of mechanical engineering with a very strong interest in the area of multibody dynamics applied to robotics, automotive technologies, crash simulation, vibration and rotor dynamics, precision machines, and technologies for rural sectors. IIT Delhi is one of the attractive destination to foreign students and faculty for academic/professional purposes.

The IMSD and ACMD conferences are biannual series that serve as a meeting point for the international multibody community and as an opportunity to exchange high-level, current information on the theory and applications of multibody systems.

The previous IMSD conferences were held at Lappeenranta, Finland (2010); Stuttgart, Germany (2012); Busan, Korea (2014); Montreal, Canada (2016) and Lisbon, Portugal (2018).

The previous ACMD conferences were held at Iwaki, Japan (2002); Seoul, Korea (2004); Tokyo, Japan (2006); Jeju, Korea (2008); Kyoto, Japan (2010); Shanghai, China (2012); Busan, Korea (2014); Kanazawa, Japan (2016) and Xi'an, China (2018).

Contributed Papers

The organizers of the conference invite unpublished research work in the following fields of Multibody dynamics (representative and non-exhaustive):

- Theoretical and computational methods
- Flexible multibody systems
- Contact and impact problems
- Control and mechatronics
- Multidisciplinary approaches
- Algorithms, integration codes and software
- Efficient methods and real-time applications
- Experiments and numerical verifications
- Optimization and sensitivity analysis
- Dynamics of machines and rotating structures
- Dynamics of all vehicles
- Robotic systems
- Biomechanics
- Other related topics

Plenary/Keynote Talks

During the conference, a set of high quality plenary talks will be delivered by experts in the field of multibody dynamics.

Workshop/Tutorials

A full day workshop and/or tutorials is planned during the conference.

Tentative Timeline

Abstract Submission: March 31, 2020

Notification of Acceptance/Rejection: April 30, 2020

Submission of Full paper: May 31, 2020

Notification of Acceptance/Rejection of Full papers: July 31, 2020

Registration (For presenters) Deadline: September 30, 2020

Registration (For attending) Deadline: October 15, 2020

Conference Dates: November 1-5, 2020

Tourism and Sight-seeing

New Delhi is the capital of the country and is directly connected by air from many cities worldwide. The weather during the conference will be pleasant (13° to 27° C). It has many historical monuments and is one of the most visited places by foreigners. Taj Mahal is one of the wonders of the world can be reached in about 3 hours by road/rail.

Visa is required to visit India. Hence, attendees are requested to get in touch with organizing team for more details.

Organizing Committee

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... (More to be added)

Website: <http://web.iitd.ac.in/~saha/imsd-acmd2020/index.html>

June 9, 2018

Forthcoming Events

4th International and 19th National Conference on Machines and Mechanisms (iNaCoMM 2019)

December 5-7, 2019

Organised by

School of Engineering, IIT Mandi



Under the aegis of
Association for Machines and Mechanisms



Introduction

School of Engineering, IIT Mandi, under the aegis of Association for Machines and Mechanisms (AMM), is organising 4th International and 19th National Conference on Machines and Mechanisms (iNaCoMM 2019) at IIT Mandi.

About the Conference

iNaCoMM 2019 is the 19th in the series of biennial conferences organised under the aegis of AMM with international status being given from 2019. The conference aims at bringing together researchers, industry experts and students working in various aspects of design and analysis of machines and mechanisms. This year the conference starts with a one-day workshop, the topic for the same will be announced soon. The deliberations in conference will be in terms of oral as well as poster presentations. Besides this there will be keynote lectures by the leading experts in the field. Selected papers from the conference will be published in scientific journals. Further it is planned to hold Students' Mechanism Design contest, an event that became part of iNaCoMM2019

About Mandi

Mandi is in the state of Himchal Pradesh, India. Mandi is a small historic town in the centre of Himachal Pradesh, on the national highway from Chandigarh to Kullu/Manali. The main campus of IIT Mandi is situated at the forested hills of Kamand village on the banks of the Uhl, a tributary of River Beas, which is approximately 18 kilometres away from Mandi town. The usual travel route to Mandi

is via Chandigarh from Delhi. The distance between Chandigarh and Mandi is ~200 kms. The nearest airports to Mandi are Kullu (Bhunter), Dharmshalla (Gaggal) & Chandigarh. Chandigarh is well connected with non-stop flights from Delhi, Mumbai, Hyderabad, Bangalore, Kolkata and Chennai. Mandi is ideally located near several tourist places like Kullu (70 km), Manali (100 km), Rewalsar (25 km) and Parashar lake (52 km). The month of December falls in winter season with temperature ranging between 10-18 degree C

IIT Mandi

Nestled in the Sivalik Range of the Himalayas, away from the bustle of the metropolis, a new abode of learning, IIT Mandi, has germinated in 2009. The focus of IIT Mandi is to spearhead cutting edge research and development of technologies needed by the world in the years to come. Research groups will work together in creating and harnessing the newest technologies needed to serve the people of the region and the country, and to tackle problems of global importance. In order to achieve excellence and high impact locally and globally, IIT Mandi focusing on strongly foster inter-disciplinary R&D. With a view to innovating sustainable technologies for widespread use, IIT Mandi encourages strong Humanities and Social Sciences participation in technology R&D..

Scope of the Conference

The conference will cover following broad areas, but not limited to

- Kinematics and dynamics of machines, Compliant Mechanisms

Editorial Board

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Prof. Shital S. Chiddarwar, VNIT, Nagpur [ZVP West]